

IN THE CLAIMS:

- 1 1. (Currently Amended) A system for transmitting a data stream having data set informa-
2 tion, the system comprising:
3 a destination system having a replica residing therein;
4 a source system in communication with the destination system, the source system
5 having a replication agent executing thereon, the replication agent adapted to generate the
6 data stream, the data stream ~~comprising of~~ including:
7 a plurality of standalone headers ~~having discrete identifiers~~, each of the
8 plurality of standalone headers being representative of a plurality of data stream charac-
9 teristics; and
10 a data following header ~~that follows, in the data stream, the plurality of~~
11 ~~standalone headers and that indicates that the data set information is following the data~~
12 ~~following header~~, the data set following header including an extended attribute field that
13 associates an extended attribute with the data set information.
- 1 2. (Previously Presented) The system as set forth in claim 1 wherein the plurality of
2 standalone headers each include an indication of one of a plurality of specialized header
3 types and at least some of the plurality of specialized header types are adapted for carry-
4 ing directory inode data.
- 1 3. (Previously Presented) The system as set forth in claim 3 wherein the data stream
2 is adapted to carry source file system inode data and source file generation numbers.
- 1 4. (Previously Presented) The system as set forth in claim 2 wherein one of the spe-
2 cialized header types comprises a deleted files type and the directory inode data com-
3 prises a list of deleted files on the source file system.

1 5. (Previously Presented) The system as set forth in claim 1 wherein the extended
2 attributes include ACLs and streams associated with a plurality of operating systems and
3 system architectures.

1 6. (Previously Presented) The system as set forth in claim 1 wherein one of the plu-
2 rality of standalone headers comprises an open file/undo header that instructs the destina-
3 tion system to revert to an earlier copy of a stored file identified by the open file/undo
4 header.

1 7. (Previously Presented) The system as set forth in claim 1 wherein the data set in-
2 formation comprises file information.

1 8. (Previously Presented) The system as set forth in claim 1 wherein the data set in-
2 formation comprises changed files on the source system transmitted for backup on the
3 replica of the destination system.

1 9. (Previously Presented) The system as set forth in claim 1 wherein the data follow-
2 ing header includes offset and block number information with respect to the data set in-
3 formation that follows the data following header.

1 10. (Previously Presented) The system as set forth in claim 1 wherein data following
2 header comprises a fixed-length record including (a) a generic part for storing an indica-
3 tion of a data following header type; (b) a non-generic part, adapted to carry predeter-
4 mined data related to the extended attribute and data related to offsets and block numbers
5 for the data set information that follows the data following header; and (c) a space for a
6 bit-code representative of a name associated with the extended attribute.

1 11. (Previously Presented) The system as set forth in claim 1 wherein each of the plu-
2 rality of standalone headers comprises a fixed-length record including a generic part for

3 storing an indication of one of a plurality of specialized header types, a non-generic part,
4 adapted to carry predetermined data related one of the specialized header types and a
5 space for additional information.

1 12. (Previously Presented) The system as set forth in claim 1 wherein the data follow-
2 ing header is adapted to be positioned within the data stream at predetermined intervals
3 that are up to approximately 2 MB of data set information in size.

1 13. (Previously Presented) The system as set forth in claim 1 wherein the destination
2 system is adapted to receive the data following header with the extended attribute and
3 cause the data set information associated with the extended attribute to be stored an entry
4 in a hidden permanent metadirectory with identifiers that are the same as identifiers for
5 the data set information in a file system of the destination system, the entry having the
6 extended attribute associated therewith so that retrieval of the entry from the hidden per-
7 manent metadirectory also retrieves the extended attribute.

1 14. (Previously Presented) The system as set forth in claim 13 wherein the destination
2 system also includes a hidden purgatory metadirectory in which current data set informa-
3 tion from the hidden permanent directory is stored during an update of the hidden perma-
4 nent metadirectory with changed data set information, the destination system being fur-
5 ther adapted to (a) delete the hidden purgatory metadirectory after a complete receipt of
6 all expected changed data set information of the hidden permanent metadirectory with the
7 changed data set information, and (b) move current data set information stored on the
8 hidden purgatory directory back to the hidden permanent metadirectory after an incom-
9 plete receipt of all expected changed data set information.

1 15. (Previously Presented) The system as set forth in claim 14 wherein the destination
2 system is adapted to create hidden new metadirectory to store changed data set informa-

3 tion for transfer to the hidden permanent directory after of the complete receipt of all the
4 expected changed data set information.

1 16. (Previously Presented) The system as set forth in claim 1 wherein the source sys-
2 tem and the destination system are remote with respect to each other and interconnected
3 by a network, and wherein the data stream is encapsulated within a networking protocol
4 adapted for transmission over the network.

1 17. (Previously Presented) A system for transmitting a data stream that includes data
2 set information, the system comprising:
3 a destination system having a replica stored thereon;
4 a source system having a replication agent executing thereon, the replication agent
5 adapted to generate the data stream, the data stream comprising of a data following
6 header appended to a predetermined-sized chunk of data, the data following header in-
7 cluding a field that identifies extended attributes associated with data set information car-
8 ried in the chunk.

1 18. (Previously Presented) The system as set forth in claim 17 wherein the extended
2 attributes include ACLs and streams associated with a plurality of operating systems and
3 system architectures.

1 19. (Previously Presented) The system as set forth in claim 17 wherein the data set in-
2 formation comprises file information.

1 20. (Previously Presented) The system as set forth in claim 17 wherein the data set in-
2 formation comprises changed files on the source system transmitted for backup on the
3 replica of the destination system.

1 21. (Previously Presented) The system as set forth in claim 17 wherein the data fol-
2 lowing header includes offset and block number information with respect to the data set
3 information that follows the data following header.

1 22. (Previously Presented) The system as set forth in claim 17 wherein data following
2 header comprises a fixed-length record including (a) a generic part for storing an indica-
3 tion of a data following header type; (b) a non-generic part, adapted to carry predeter-
4 mined data related to the extended attribute and data related to offsets and block numbers
5 for the data set information that follows the data following header; and (c) a space for a
6 bit-code representative of a name associated with the extended attribute.

1 23. (Previously Presented) The system as set forth in claim 17 wherein the chunk has
2 a size of up to approximately 2 MB of data set information.

1 24. (Previously Presented) The system as set forth in claim 17 wherein the destination
2 system is adapted to receive the data following header with the extended attribute and
3 cause the data set information associated with the extended attribute to be stored an entry
4 in a hidden permanent metadirectory with identifiers that are the same as identifiers for
5 the data set information in a file system of the destination system, the entry having the
6 extended attribute associated therewith so that retrieval of the entry from the hidden per-
7 manent metadirectory also retrieves the extended attribute.

1 25. (Previously Presented) The system as set forth in claim 24 wherein the destination
2 system also includes a hidden purgatory metadirectory in which current data set informa-
3 tion from the hidden permanent directory is stored during an update of the hidden perma-
4 nent metadirectory with changed data set information, the destination system being fur-
5 ther adapted to (a) delete the hidden purgatory metadirectory after a complete receipt of
6 all expected changed data set information of the hidden permanent metadirectory with the
7 changed data set information, and (b) move current data set information stored on the

8 hidden purgatory directory back to the hidden permanent metadirectory after an incom-
9 plete receipt of all expected changed data set information.

1 26. (Previously Presented) The system as set forth in claim 25 wherein the destination
2 system is adapted to create hidden new metadirectory to store changed data set informa-
3 tion for transfer to the hidden permanent directory after of the complete receipt of all the
4 expected changed data set information.

1 27. (Original) A method for storing and retrieving extended attributes associated with a
2 data set information comprising:
3 storing a current data set information with current extended attributes in a perma-
4 nent hidden metadirectory;
5 transferring the data set information to a purgatory metadirectory upon receipt of
6 a changed data set information;
7 storing the received changed data set information in a new metadirectory; and
8 upon completion of receipt of all expected changed data set information, transfer-
9 ring the received changed data set information from the new metadirectory to the perma-
10 nent metadirectory, the permanent metadirectory thereby being available for retrieval of
11 extended attributes associated with the data set information.

1 28. (Original) The method as set forth in claim 27 further comprising the step of, upon a
2 failure to complete receipt of all expected changed data set information, transferring the
3 current data set information with the current extended attributes back to the permanent
4 metadirectory.

1 29. (Original) The method as set forth in claim 28 wherein the data set information com-
2 prises files organized in a directory tree structure the same as a file system structure on
3 the destination system and wherein the extended attributes comprise ACLs and streams
4 associated with the files.

1 30. (Original) The method as set forth in claim 29 further comprising the step of deleting
2 the purgatory metadirectory after one of, either (a) the transferring of the changed data set
3 information from the new metadirectory to the permanent metadirectory or (b) the trans-
4 ferring of the current data set information from the purgatory metadirectory back to the
5 permanent metadirectory.

1 31. (Original) The method as set forth in claim 30 further comprising, upon a request
2 from the source to restore data sets from the data set information, scanning the permanent
3 directory and retrieving the data sets including retrieving respective of the extended at-
4 tributes associated with the data sets.

1 32. (Original) The method as set forth in claim 31 further comprising the step of provid-
2 ing the retrieved data sets' extended attributes in a format for transmission to the source
3 from the destination, the format including data following headers each having a field that
4 associates the respective of the extended attributes with the retrieved data sets.

1 33. (Original) The method as set forth in claim 32 wherein the respective of the extended
2 attributes are associated with the data sets based upon NT streams.

1 34. (Original) The method as set forth in claim 27 wherein the extended attributes are
2 associated with the data set information in the permanent metadirectory using NT
3 streams.

1 35. (Original) The method as set forth in claim 27 further comprising the step of provid-
2 ing the data sets' extended attributes in a format for transmission to the destination from
3 the source, the format including data following headers each having a field that associates
4 the respective of the extended attributes with the retrieved data sets.

1 36. (Original) A method for ensuring coherency in a data set transmitted from a source
2 system to a replica on a destination system comprising the steps of:
3 retrieving a first modification time on the source system for the data set;
4 opening the data set on the source system and transmitting the data set from the
5 source system to the destination;
6 after completing transmitting, closing the data set on the source system and re-
7 trieving second modification time on the source system; and
8 if the second modification time and the first modification time are not the same,
9 providing by the source system an instruction to the destination system to revert to an
10 earlier stored copy of the data set on the replica.

1 37. (Original) The method as set forth in claim 36 wherein the step of providing the in-
2 struction comprises transmitting an undo standalone header in a data stream that includes
3 the data set, the standalone header identifying the data set and indicating an undo header
4 type.

1 38. (Previously Presented) A computer readable medium for storing and retrieving ex-
2 tended attributes associated with a data set information, the computer readable medium
3 including program instructions for performing the steps of::
4 storing a current data set information with current extended attributes in a perma-
5 nent hidden metadirectory;
6 transferring the data set information to a purgatory metadirectory upon receipt of
7 a changed data set information;
8 storing the received changed data set information in a new metadirectory; and
9 upon completion of receipt of all expected changed data set information, transfer-
10 ring the received changed data set information from the new metadirectory to the perma-
11 nent metadirectory, the permanent metadirectory thereby being available for retrieval of
12 extended attributes associated with the data set information.

1 39. (Previously Presented) A computer readable medium for ensuring coherency in a
2 data set transmitted from a source system to a replica on a destination system, the com-
3 puter readable medium including program instructions for performing the steps of:
4 retrieving a first modification time on the source system for the data set;
5 opening the data set on the source system and transmitting the data set from the
6 source system to the destination;
7 after completing transmitting, closing the data set on the source system and re-
8 trievaling second modification time on the source system; and
9 if the second modification time and the first modification time are not the same,
10 providing by the source system an instruction to the destination system to revert to an
11 earlier stored copy of the data set on the replica.

1 40. (New) A system for transmitting a data stream, the system comprising:
2 an operating system for a destination data storage system, the operating system
3 configured to receive the data stream and maintain a replica of a data set of the source
4 system; having a replica residing therein;
5 a plurality of standalone headers in the data stream, the plurality of standalone
6 headers having discrete identifiers, each of the plurality of standalone headers being rep-
7 resentative of a plurality of data stream characteristics; and
8 a data following header in the data stream, the data following header having an
9 extended attribute field that associates an extended attribute with the data in the data
10 stream, the extended attribute including metadata external to the data set.

1 41. (New) A method for backing up data from a source to destination data storage sys-
2 tem, the method comprising:
3 formatting, by the source, a data stream including system specific attributes, by append-
4 ing, to the data stream, a plurality of standalone headers and a plurality of data following
5 headers,

6 the standalone headers including information which characterize data in the data
7 stream,
8 the data following headers including extended attributes which identify system
9 specific attributes of data in the data stream,
10 communicating the formatted data stream from the source to the destination data
11 storage system.

1 42. (New) The method of claim 41, further comprising:
2 interpreting the information, by the data storage system, as instructions for handling data
3 in the data stream according to the system specific attributes if the system specific attrib-
4 utes are compatible with the destination data storage system; and
5 interpreting the information, by the data storage system, as instructions for ignoring the
6 system specific attributes if the system specific attributes are incompatible with the desti-
7 nation data storage system

1 43. (New) The method of claim 41, wherein the data following headers include space
2 for the extended attributes to store self-descriptive information.